K.-Michael Aye
Laboratory for Atmospheric and Space Physics
email: michael.aye@lasp.colorado.edu

Response to:
NNH15ZDA012L: Request for Information:
"Preparation for the development of a community-based roadmap for the Planetary Data System and associated organizations."

January 25, 2016

SPICE-based preview utilities for PDS data

1. Statement of topic

This response to the above NASA RFI discusses the use of SPICE-based ancillary data preview utilities for PDS data. This tool request is in principle applicable to all PDS nodes. It describes the need of a general graphical display of the observational situation for any remote sensing planetary mission that is using SPICE based navigation and the respective ancillary data products related to it. Each PDS data product has either one or a set of time stamps that are directly related to an existing geometrical situation between the observing body and the observed object. The goal is to provide a one-click display of the geometrical situation for a given data product to the PDS end user.

2. Rationale

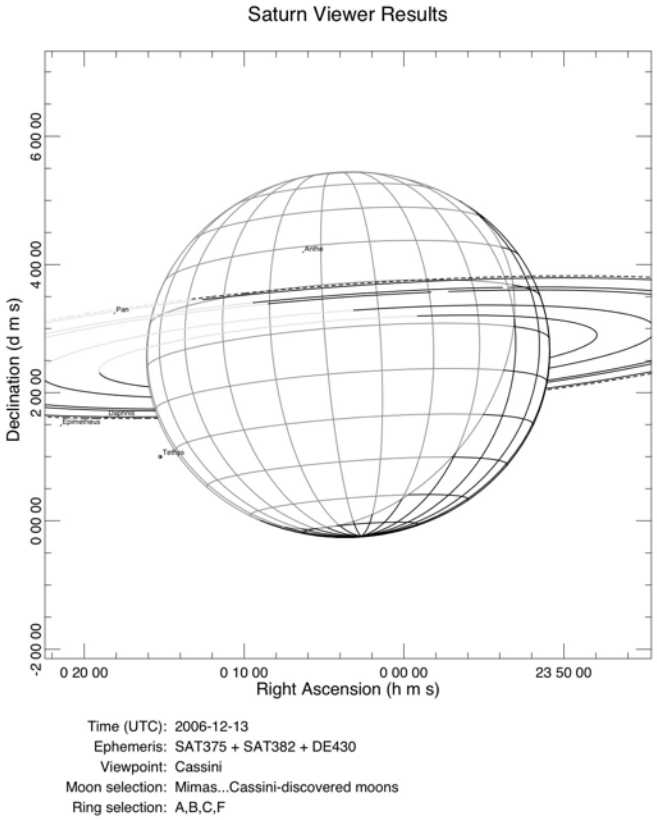
A precise understanding of the geometry of a planetary science remote sensing observation is required to conclusively analyze the data from that observation. The geometry provides always important context for the observation, and for the most part even required information for the

calibration, i.e. for the creation of a data product in physical units. Even if the calibration work is mostly done by instrument teams that delivered the data product in question, an interdisciplinary study (between different instruments or different fields of physics) often requires information that was not necessarily important for the calibration of the data of one instrument.

Additionally, the user could be interested in an observational scenario that is currently not search-able by the offered search engines; being immediately able to decide if a PDS product is relevant to the PDS user by a 3D geometry display of the observation would highly improve the efficiency of finding data. Numerical data responses from search engines need to be interpreted while an interactive 3D display very fast enables an understanding of the given observational scenario.

3. Suggested improvements

Fig. 1: Output of the Cassini Saturn viewer of the PDS Ring-Moon Systems node



Several successful attempts have been made to provide the geometrical context as described in section 2. One example is the Cassini/Saturn Viewer as available on the Rings-Moon node (http://pds-rings.seti.org/tools/viewer2_satc.html). Figure 1 shows the output of a use case for that tool. The user is required to manually enter each ancillary data parameter required to draw the shown drawing.
My suggestions are as follows:
a)Each data product not only has a time stamp (or a series of time stamps) but also is related to an instrument that (for the most part) has a field of view and an observation pointing, both of which are contained in the labels or ancillary data files related to the observation at hand.

The manual entering of this data is therefore superfluous as all this data can be connected to the data product currently under investigation. While it is still useful to provide tools like the Saturn Viewer for the case when the end user has the time stamps and or field of views and target bodies available from a third source, it would be a tremendous help if simply every data product could draw the situation it was taken in on its own.

b) Modern web tools include interactive 3D graphics, for example based on WebGL. Making the graphic of the Saturn Viewer interactive (especially rotate-able) would enable an even better understanding of the geometry of the observation. Activities of the NAIF SPICE team are beginning to standardize these kinds of displays by using a program called Cosmographia (output shown in Fig. 2), but simpler 3D graphic displays directly in the web browser are possible today, simpler in detail, possible, but fully interactive while shown in the the browser.

c) The NAIF SPICE team under Chuck Acton has made great efforts in bringing the hard to grasp SPICE concepts to the web with WebGeoCalc. Combining this idea with a graphical engine similar to Cosmographia or other web-based graphical engines would make the suggested improvements possible. I therefore strongly suggest to increase the funding strength to the SPICE team to have these efforts coordinated between PDS and NAIF to enable a reliable product that could be both used for interactive use and as observation description in publications.

4. Impact

Most of my colleagues in planetary sciences that are heavily involved in planetary data analysis have written some kind of tool to inform them about the geometry of an observation. Without standardization of these common activities to understand an observation — in contrast to scientific analysis, ancillary geometrical data of observations are some of the few common analysis aspects of every planetary mission — many scientists will spend time and effort and most likely tax-payer based funding to generate this improved understanding of an observation.

5. Potential

A united effort in standardizing 3D interactive displays for PDS data products would immensely help in identifying relevant data products and reduce every PDS end users efforts in

describing the observational scenario to the reviewer of potential applications. Errors from individual efforts can be minimized by having a standard in 3D display for observations. The effort for reviewers in understanding publications would be reduced as well.

Fig. 2: Output of NAIF SPICE's Cosmographia tool.